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White Pine Plantations in Moist Forests: Do They Make Sense with Increased Wildfire Potential?

The changing climate is forcing foresters to rethink how and where they replant after a wildfire.

Fire suppression and the loss of western white pine (WPP) to disease have made northern Rocky Mountain moist mixed-conifer forests less resilient to disturbance. Western white pine historically influenced the fire regime, creating a more herbaceous understory, which increased humidity and decreased the severity of fire burning through these stands of western wite pine. The introduction of the invasive disease white pine blister rust killed countless western white pines from the 1940s through the 1970s. Vast areas of western white pine were salvage logged beginning in 1960s. Resistant trees were identified and crossed to develop a genetically resistant tree, and western white pine plantations dominated by blister rust-resistant seedlings became common. Most blister rust-resistant western white pine plantations have not experienced wildfire since establishment.

Recently published work by Terrie Jain, Rocky Mountain Research Station (RMRS) research forester, along with colleagues from RMRS and the University of Idaho, sought to identify western white pine plantations that had a greater chance of surviving a wildfire and to determine where it makes sense to focus reforestation efforts after a wildfire.

The research team evaluated the fire resistance of northern Rocky Mountain plantations in the Idaho Panhandle and Nez Perce–Clearwater National Forests

Postfire response varies among sites after a wildfire: an example of a site dominated by moss (A), versus a site dominated by a variety of plants (B). USDA US Forest Service photo.

after wildfires in 2015. Wildfire was more prevalent in moist mixed-conifer forests due to extreme weather conditions that year.

"With more wildfire in the future," Jain says, "we addressed two management issues: first, the future placement of plantations so they are more adaptable to wildfire disturbances, and second, how to focus reforestation resources to sites with the highest potential for success."

The researchers used a combined landscape-scale and site-specific approach. They first used remote sensing to classify the fires into different severities for sampling. Then they visited the plantations to identify the topographic variables and plantation characteristics influencing fire severity and sapling survival.

Forest managers requested the use of a distribution of burn severity rather than an average (low, moderate, or high) across a fire perimeter. The team used the differenced normalized burn ratio (dNBR), a continuous variable that reflects the mosaic of burn severity within a plantation.

Key Findings and Management Implications

- Western white pine plantations in Idaho, USA, were found to be more resilient in moist locations where water tends to settle and temperatures are slightly cooler. These locations—such as lower slopes, draws, and drainages—have deeper ash cap soils, which have a higher water-holding capacity and are more fire resilient.
- Plantations above mid-slope and on south-facing slopes greater than 30 percent have less resilience and poorer wildfire survival. These sites are likely to need reforestation after a wildfire, probably with ponderosa pine and other species besides western white pine.
- Snow water equivalent—a measure of soil moisture—was positively correlated with wildfire resistance and resilience of western white pine plantations in this study.

Results showed that plantations on lower slopes, even when steep, had less wildfire mortality. The research team concluded that these are likely to be the better places to establish new stands of western white pine after a wildfire. This species also tended to dominate lower slopes in the past.

Jain and colleagues identified the most sapling mortality from wildfires occurred on steep, south-facing slopes and above mid-slopes, indicating that these places are vulnerable to fire damage.

Forest managers can use these results, albeit from only one fire season, for adapting management strategies to enhance plantation survival and reforestation strategies following wildfire.

FURTHER READING

Jain, Theresa B.; Nelson, Andrew S.; Bright, Benjamin C.; Byrne, John C.; Hudak, Andrew T. 2022. Biophysical settings that influenced plantation survival during the 2015 wildfires in Northern Rocky Mountain moist mixed-conifer forests. Journal of Forestry. 120(1): 22–36.

Fins, Lauren; Byler, James; Ferguson, Dennis; Harvey, Al; Mahalovich, Mary Francis; McDonald, Geral I.; Miller, Dan; Schwandt, John; Zack, Art. 2001. Return of the giants: Restoring white pine ecosystems by breeding and aggressive planting of blister rust-resistant white pines. Station Bulletin 72. Moscow, ID: University of Idaho, Wildlife and Range Experiment Station. 21 p.

Lead Scientist

Terrie Jain is a research forester with RMRS in Moscow, Idaho. She is passionate about bringing scientific knowledge to inform management decisions.